

WHAT IS CLAIMED IS:

1. A lithium secondary battery comprising a negative electrode containing lithium metal or a material previously storing lithium as an active material, a positive electrode
5 containing a positive active material, and an electrolyte containing a non-aqueous electrolyte solution, wherein said positive active material is a thin film formed by depositing on a substrate from vapor phase or liquid phase and including an oxide containing at least iron as a main
10 constituent.

2. The lithium secondary battery according to claim 1, wherein said thin film contains a crystal of Fe_2O_3 or Fe_3O_4 .

3. The lithium secondary battery according to claim 1, wherein said thin film has columnar structure extended
15 substantially in the vertical direction to the substrate.

4. The lithium secondary battery according to claim 1, wherein said film-forming method is a sputtering method, a reactive deposition method, a vacuum deposition method, a chemical vapor deposition method, a spraying method, a
20 plating method, or a method in combination of these methods.

5. The lithium secondary battery according to claim 1, wherein said oxide containing iron contains potassium.

6. The lithium secondary battery according to claim 5, wherein the concentration of said potassium is gradually
25 decreased as closer to the surface from the substrate in the

thickness direction.

7. The lithium secondary battery according to claim 5, wherein said oxide containing iron and potassium further contains carbon.

5 8. The lithium secondary battery according to claim 1, wherein said substrate has electron conductivity.

9. The lithium secondary battery according to claim 8, wherein said substrate is made of a metal or an alloy.

10 10. The lithium secondary battery according to claim 9, wherein said substrate is made of aluminum or an aluminum alloy.

11. The lithium secondary battery according to claim 1, wherein said substrate constituent and said thin film constituent are mutually diffused in the interface of said substrate and said thin film.

12. A positive electrode for a lithium secondary battery formed by depositing a thin film of an active material on a current collector from vapor phase or liquid phase, wherein said thin film includes an oxide containing at least iron as a main constituent.

13. The positive electrode for the lithium secondary battery according to claim 12, wherein said thin film contains a crystal of Fe_2O_3 or Fe_3O_4 .

14. The positive electrode for the lithium secondary battery according to claim 12, wherein said thin film has

columnar structure extended approximately in the vertical direction to said substrate.

15. The positive electrode for the lithium secondary battery according to claim 12, wherein said oxide containing iron contains potassium.

16. The positive electrode for the lithium secondary battery according to claim 15, wherein the concentration of said potassium is gradually decreased as closer to the surface from the substrate in the thickness direction.

17. The positive electrode for the lithium secondary battery according to claim 15, wherein said oxide containing iron and potassium further contains carbon.

18. The positive electrode for the lithium secondary battery according to claim 12, wherein said substrate constituent and said thin film constituent are mutually diffused in the interface of said substrate and said thin film.

19. The positive electrode for the lithium secondary battery according to claim 12, wherein said film-forming method is a sputtering method, a reactive deposition method, a vacuum deposition method, a chemical vapor deposition method, a spraying method, a plating method, or a method in combination of these methods.